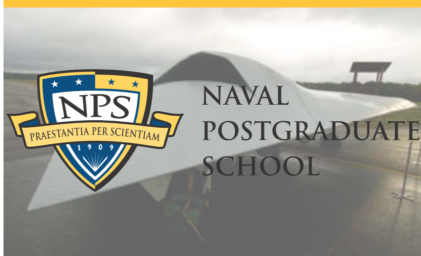
ISSUE 4 JUNE 2011

CRUSER • NEWS

Consortium for Robotics and Unmanned Systems Education and Research

FROM TECHNICAL TO ETHICAL

FROM CONCEPT GENERATION TO EXPERIMENTATION



INSIDE THIS ISSUE

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Maritime Surveillance in the Intracoastal Waterway using Networked Underwater Acoustic Sensors integrated with a Regional Command Center

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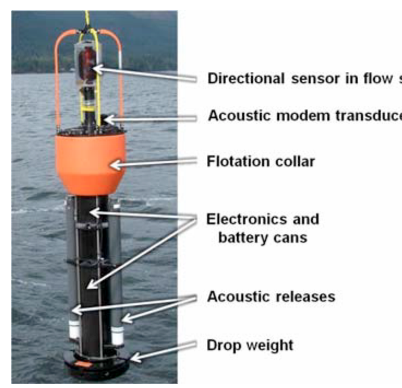
Underwater passive acoustic directional sensors and Seaweb through-water networked acoustic communications are implemented in the Intracoastal Waterway at Morehead City, North Carolina on the U.S. eastern seaboard. The objective is to demonstrate capability for first-alert protection of a high-value port facility against asymmetric threats that intelligence sources indicate are arriving via watercraft. Battery-powered acoustic sensors are rapidly deployed at widely separated chokepoint locations in shallow 5-10 meter water. These sensors autonomously detect the passage of a maritime vessel and generate a contact report indicating time, location and heading of the target. Seaweb through-water acoustic communications delivers the contact report via a scalable wide-area underwater network including multiple acoustic repeater nodes and a radio/acoustic communications (Racom) gateway buoy. The Racom gateway telemeters the contact report via Iridium satellite communications to an ashore command center with low latency. The in situ acoustic detection is corroborated using shore-based video surveillance to classify the contact as friendly or actionable.

I. Introduction

Maritime points of entry, much like airports and borders, are the front lines in our defense against terrorism, smuggling, and other international crimes. Bays, harbors, and ports are especially vulnerable to illegal operations because of their large area and the difficulty of monitoring them. Increased vigilance of these maritime points of entry is required.



Automatic Identification System (AIS) has proven useful for reporting legitimate traffic, but this voluntary tagging of vessels does not identify asymmetric and irregular (i.e., "dark") maritime threats, and is susceptible to false reporting by malicious vessels.

Continued on page 3

CRUSER News Contributions

Short articles of about 200-300 words are needed for future CRUSER News'.

Please contact Lisa Trawick at cruser@nps.edu for additional inform

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE **JUN 2011**	2. REPORT TYPE	3. DATES COVERED **00-00-2011 to 00-00-2011**

4. TITLE AND SUBTITLE **Cruser News. Issue 4, May 2011.**	5a. CONTRACT NUMBER 5b. GRANT NUMBER 5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER 5e. TASK NUMBER 5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Postgraduate School,Consortium for Robotics and Unmanned Systems Education and Research (CRUSER),Monterey,CA,93943**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S) 11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**4**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

DIRECTOR'S CORNER

CAPT Wayne Hughes, USN (ret) and author of Fleet Tactics, likes to say we are on the dawn of the "robotics age" of warfare. CRUSER's goal is to provide a catalyst within the unmanned systems community for constructive research, thought, information exchange, and experimentation to effectively realize the robotics age. We hope this CRUSER News issue reflects that objective. We invite each of our members to submit a brief article sharing your work in future issues, contribute to our on-line calendar, and invite others to join CRUSER

Capt (ret) Jeff Kline, USN
CRUSER Director

"What's in a Name"

by Mark Ballinger

25 years ago, they were called Remotely Piloted Vehicles or RPV's. It was a step up from Drone which was the term used during the Viet Nam war and before. There were variations of course. NASA called them Remotely Operated Aircraft (ROA) for a while. The good thing is that there was not much confusion. DoD named the technology, and we all jumped on the bandwagon. Even later when RPV was changed to Unmanned Aerial Vehicle (UAV) to indicate a higher level of autonomy, the terminology was never confused. The acronym was defined and everyone knew what it meant. There were some variations during the 1990's too. I like the attempt at political correctness with the Uninhabited Combat Air Vehicle. It didn't catch on. Later it became the Unmanned Combat Air Vehicle (UCAV), the first term to define armed UAV's.
A few years ago, the terminology changed again to UAS. Somehow the change from UAV to UAS was confusing to people, especially the media. Only one letter changed in the acronym, but two words changed. As defined by DoD in JCS Pub 1-02, and the FAA, UAS stands for Unmanned Aircraft System. The word Aerial was changed to Aircraft to indicate a shift in the thinking of what these systems are and should be. For the FAA it meant that the regulations by which we fly these systems apply as they do with any aircraft. For many years there was a sort of "Don't Ask, Don't Tell" mentality in the FAA about the RPV's and UAV's that were being flown around the country. Companies that are well known today were taking their unmanned aircraft to the nearest open space and testing their systems. The FAA had not declared that the "Vehicles" were aircraft and that the rules of Title 14 CFR apply. That all changed in 2005. DoD wanted to stress the System aspect of the UAS as well. Its not just the airframe, but the ground station and datalink too.

The reasons for the change from UAV to UAS were laid out, but a great deal of confusion remained. Was it Unmanned AERIAL System or Unmanned AIRCRAFT System? I recall a discussion with some people who had just started a new company and I indicated they had used the terminology incorrectly. That did not go over very well, I can tell you.
Are we going to change to Remotely Piloted Aircraft in the future as the US Air Force is doing? I hope so. We still require a pilot at the controls, especially if the aircraft is armed. It would remove the confusion around UAS too.
In the mean time, the official terminology is Unmanned Aircraft System. But don't rely on the media or me for the right answer. Look it up! Even Wikipedia has it correct now. Go to Joint Publication 1-02 and see for yourself.
http://www.dtic.mil/doctrine/dod_dictionary/

Mark Ballinger has been an unmanned aircraft pilot for 25 years and still refuses to be called the operator.

Mark Ballinger
Major USMC Retired
Chief Unmanned Aircraft Pilot
Raytheon Missile Systems
www.raytheon.com

Thesis Topic Submission by DoD Organizations

Does your DoD Organization have a potential graduate thesis topic related to unmanned systems they would like to find NPS students to research? Please contact Lisa at cruser@nps.edu for additional information. CRUSER has funds for student travel to support thesis research and attend experiments in CRUSER related topics.

Ten Years Later: Warfare Ethics Since 9/11

by Mark Dankel

VADM Stockdale Center for Ethical Leadership - 2011
McCain Conference
U.S. Naval Academy
7-8 April, 2011

This year's McCain Conference focused upon multiple moral and ethical dimensions of jus ad bellum (the right to go to war) and jus in bello (right conduct of war) within the context of present asymmetric conflicts. In classical western theory, to be "just" a war must be waged by legitimate authority, based upon a just cause, with right intention, a probability of success, observing the principles of proportionality (benefit expected weighed against the likely damage and injury) and discrimination (non-combatant immunity). Some would add war may only be entered upon as a last resort. What is the relevance for CRUSER? Potentially, a great deal.

We are all familiar with concerns being voiced regarding development and deployment of autonomous lethal technologies, e.g. "killer robots." The arguments for and against them are ongoing and will no doubt continue, as this technology becomes a practical possibility. But there are myriad uses for robotic technology that can make very significant contributions to tactical decisions within the boundaries of jus ad bellum and jus in bello. Surveillance and communications capabilities of remote unmanned sensors provide real-time information regarding potential and suspected threats to security at home and abroad. This information, collected, analyzed and shared within our intelligence communities, may directly inform decisions regarding the need for pre-emptive and preventive interventions. In efforts to build coalitions with NATO or the UN, this kind of information can become the currency of political will. In asymmetric conflicts, where the enemy's proximity to non-combatant civilians creates high-risk situations both for them and for coalition personnel, robotic platforms can provide capabilities representing affirmative actions taken precisely to reduce collateral risks to civilians while simultaneously diminishing risks to which our personnel must be exposed. Relatively inexpensive "swarm" technologies may provide early intervention choices short of full-scale war and invasion – the equivalent of a "shot across the bow" – that may de-escalate tensions before they become irreversible.

In short, by providing additional choices, CRUSER research can aid our armed forces and elected political leadership execute their responsibilities for the nation's security and interests abroad better informed and within the boundaries of our ethical and moral traditions and values. In what to some may appear ironic, CRUSER research has the real potential to aid our humanity by helping to avoid conflicts where possible, and prosecuting them more justly where they cannot be.

Detailed Report at https://wiki.nps.edu/display/CRUSER/CRUSER+News+Articles

Maritime Surveillance (cont)

Effective maritime surveillance requires the use of in situ sensors to independently detect the passage of watercraft and to report these contacts to a regional command center for data fusion with both AIS and remote sensing systems deployed in space or ashore.

We propose the use of distributed passive underwater acoustic sensors with autonomous processing for detecting maritime targets, as depicted in Fig. 1. These underwater acoustic sensors are derived from decades of U.S. Navy research in anti-submarine warfare (ASW). Their utility against relatively noisy surface vessels is very good. Furthermore, we propose the use of Seaweb through-water acoustic communications to deliver actionable contact reports to a regional command center in near-

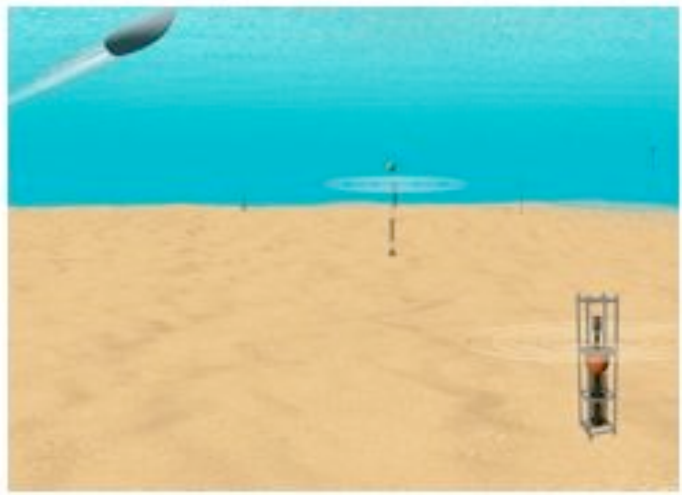


Figure 1. In the foreground is an underwater networked acoustic sensor on the seabed detecting the passage of a surface vessel. In the background are additional distributed network nodes including a Racom gateway buoy providing for near-real-time exfiltration of

As a demonstration, we implement such a capability as part of the ONR Operational Adaptation (OA) Integrated Technology Demonstration (ITD-1) Developmental Test #2 (DT-2) during February 2010 at Morehead City, North Carolina, USA. The exercise scenario is described in Fig. 2. The strategy here is that the underwater sensor network will alert the regional command center to evaluate the contact with respect to other intelligence, surveillance and reconnaissance (ISR) data, and to cue ashore or overhead video assets. We exploit the proximity of the shoreline to implement visual surveillance for coincident observation of maritime targets.

Initially, individual systems, such as the Seaweb sensor network, are deployed and shakedown tests conducted. This is followed by an integration period when the disparate sensor inputs are fused to produce an overall operational picture. Finally, a series of exercise events are staged to evaluate the effectiveness of each system and the utility of the integrated maritime surveillance capability.

Full article at https://wiki.nps.edu/display/CRUSER/CRUSER+News+Articles

STUDENT RESEARCH: IN-PROGRESS

SYSTEMS ENGINEERING ANALYSIS COHORT 17 TEAM B (SEA-17B) LED BY LT JIM DRENNAN
ADVANCED UNDERSEA WARFARE SYSTEMS

Over the next twenty years, the proliferation of threats in the undersea environment will likely challenge the platform-centric model that the United States Navy uses to maintain dominance in Undersea Warfare (USW). Meanwhile, rapidly maturing technologies offer greater capabilities to potential adversaries around the world. Such a paradigm creates an imperative for the Navy to harness emerging technologies to maintain USW dominance amid a dynamic threat environment, while balancing cost, risk, and required performance. This systems engineering analysis develops Advanced Undersea Warfare Systems (AUWS) that provide a technological and tactical advantage based on the needs of the warfighter. Following critical analysis of the numerous possible alternatives for performing the necessary C4ISR and prosecution and an objective screening process, four system architectures – and associated operational concepts – are selected for detailed analysis. From cost, risk, and performance analyses, superior AUWS concepts are shown to be flexible, scalable, and tailorable systems that balance critical need areas. This analysis highlights the need for new warfare systems that can meet future challenges to the traditional platform-centric model for USW dominance. Using the results and recommendations in this analysis will allow the Navy to deploy capabilities that effectively and efficiently meet future operational needs.

The Future of Unmanned Naval Technologies: A Second Look

A Discussion with Admiral Gary Roughead, Chief of Naval Operations

EVENT SUMMARY

On May 13, the 21st Century Defense Initiative at Brookings hosted Admiral Gary Roughead, chief of naval operations, for a discussion of the U.S. Navy's use of unmanned naval technologies. Admiral Roughead, who addressed this issue at Brookings in 2009, gave an update on the development and integration of these systems into the current and future Navy force structure; the challenges that the Navy has encountered in deploying these systems; and the lessons learned to date. He also addressed the major operational challenges and benefits of new and rapidly evolving technologies and spoke to the doctrinal, legal and ethical questions that arise when using unmanned naval systems.

http://www.auvac.org/community-information/community-news/view/1028

Abstracted comments on Unmanned Underwater Systems:

"I'm also very pleased that we have been able to keep the press on in unmanned underwater systems. In the session that I had here a couple of years ago and in different venues where I have had the opportunity to speak about unmanned systems, I've challenged the technical community, the research community, the academic community to give us power in unmanned underwater systems. Safe, shipboard, long duration power is the coin of the realm. And I've been extraordinarily pleased with the response that we've received and some of the durations that we're now beginning to see in that technology.

I'm also pleased with some of the tests that we have run with network unmanned underwater systems that I think will have the potential, if we do it right, of changing the underwater domain. So the fact that when we talk unmanned, we tend to look up in the sky, I look underwater, because that is an area where you can truly change naval warfare."

Full article at https://wiki.nps.edu/display/CRUSER/CRUSER+News+Articles

CALENDAR OF EVENTS

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Submit your events: http://www.nps.edu/Research/cruser/cruser_EventSub_Form.html

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